

CHAPTER 13

CHEMICAL TREATMENT

13-1. Minimum maintenance activities for chemical treatment

The tables located at the end of this chapter indicate items that must be performed to maintain systems and equipment at a minimum level of operational readiness. The listed minimum action items should be supplemented by manufacturer-recommended maintenance activities and procedures for specific pieces of equipment. Maintenance actions included in this section are for various modes of operation, subsystems, or components. Table 13-1 provides maintenance information for all water systems (potable and process). Table 13-2 provides maintenance information for chemical feed systems with electric motor-driven reciprocating plunger metering pump. Table 13-3 provides maintenance information for chemical feed systems with water-powered piston action metering pump. Table 13-4 provides maintenance information for resin bed water softeners and dealkalizers. Table 13-5 provides maintenance information for resin bed ion exchange units. Table 13-6 provides maintenance information for chemical treatment systems instrumentation and electrical.

13-2. General maintenance procedures for chemical treatment

This section presents general instructions for maintaining the types of components associated with chemical treatment.

a. Inspect chemical feed systems. Start at the chemical feed tanks and follow the chemical feed system piping all the way to the points of end use. Inspect for:

- (1) Leaking tanks and piping and/or corrosion
 - (2) Missing identification tags on system valves and components
 - (3) Sagging or misalignment of piping
 - (4) Adequate chemical solution levels in feed tanks to sustain treatment process until next inspection
 - (5) Proper readouts on instruments and gauges, and proper function of control system and feed system components
 - (6) Plugged or damaged piping
 - (7) Operating equipment making usual noises, vibrating excessively, or running hotter than normal
- b. Exercise valves.* Exercise all valves in the chemical feed system.
- (1) Inspect packing gland and tighten if necessary.
 - (2) Check for correct positioning and operation.

(3) Check for leaking seals.

(4) Adjust operator linkages and limit switches on control valves.

c. *Test alarms.* Verify that the horns sound and all annunciator lights illuminate by pressing the appropriate test push buttons. Press the ACKNOWLEDGE and RESET push buttons when proper operation has been confirmed.

d. *Chemical metering pump calibration.* A common method of verifying the pumping rate of a metering pump is by means of a test tube calibration column. A typical test tube calibration column installation is shown on Figure 13-1. The pumping rate at a given setting is determined as follows.

(1) With the metering pump operating normally and the storage tank level higher than top of calibration column, open Valve B and allow the calibration column to fill.

(2) When the liquid level reaches the zero division mark, close Valve A and start timer. **Do not fill above the zero division mark.** (Note: Any division mark may be used as a starting point; however, filling to the zero mark allows a longer time interval which increases accuracy.)

(3) After a timed interval of not less than 30 seconds, note the reading on the calibration column and the time interval, and open Valve A and close Valve B.

(4) Determine pumping rate by dividing amount pumped by the time interval. (Note: Follow directions on calibration column to determine flow rate units.)

(5) Check the measured flow rate against the setting on the pump. If the actual flow rate is significantly different than the set flow rate, repeat Items 1 through 4 to confirm difference before taking action.

e. *Clean all equipment.* Clean equipment is easier to inspect, lubricate, and adjust. Clean equipment also runs cooler and looks better.

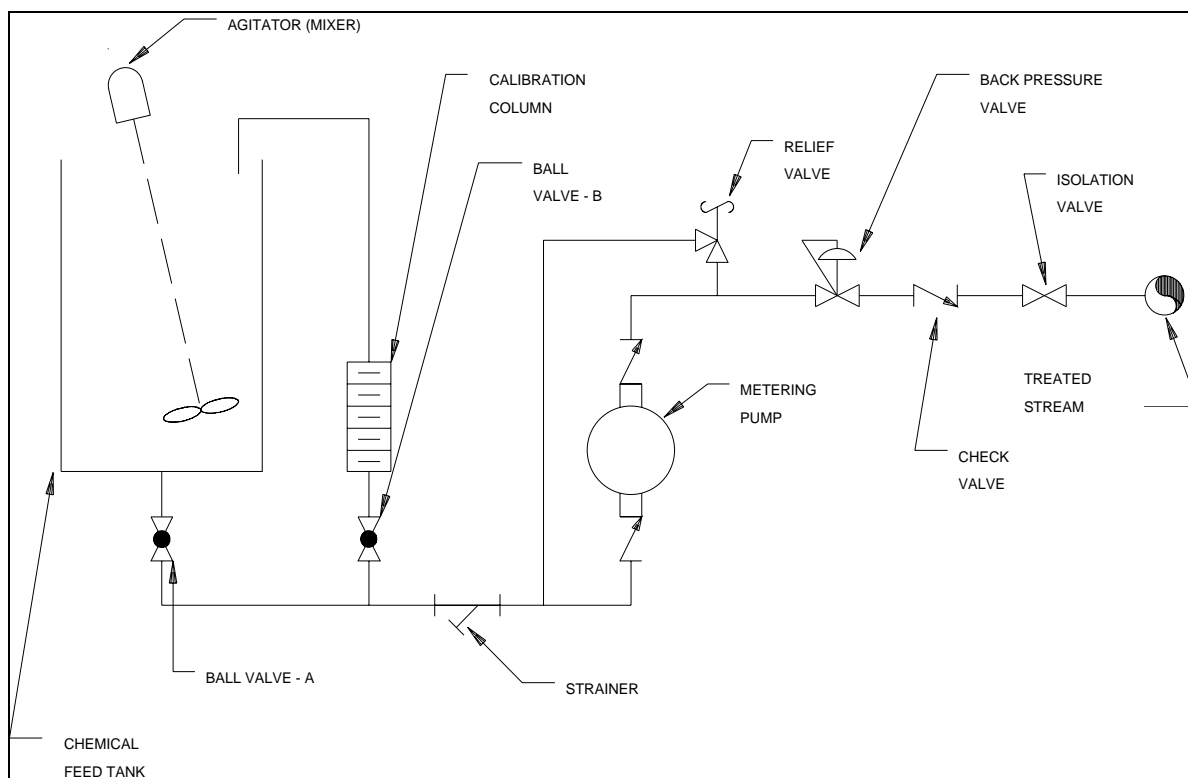


Figure 13-1. Typical test tube calibration column installation

Table 13-1. All water systems (potable and process)

All Water Systems (Potable and Process)	
<i>Action</i>	<i>Frequency</i>
Potable Water Supply and Reservoir	
Obtain samples at a number of locations throughout the potable water system and analyze for residual chlorine.	day
Adjust supply chlorinator unit as required to obtain desired residual chlorine level.	day
Operate potable water system recirculating chlorinator loop as required to obtain desired residual chlorine level in reservoir.	as req'd
Industrial Reservoir	
Obtain samples from the industrial reservoir and analyze for residual chlorine.	day
Operate industrial reservoir recirculating chlorinator loop as required to obtain desired residual chlorine level in reservoir.	as req'd
Chilled Water System (Closed)	
Obtain samples from the chilled water system and analyze for:	
Specific gravity (antifreeze concentration).	yr ¹
Corrosion inhibitor concentration (using chemical manufacturer recommended test kit).	yr ¹
pH.	yr ¹
Biological contamination and/or biological inhibitor concentration (using chemical manufacturer recommended test kit).	yr ¹
Dose system with appropriate chemicals or drain, flush, and refill system.	as req'd
Cooling Water Recirculating System (Closed Loop)	
Obtain samples from the hot water system and analyze for:	
Corrosion inhibitor concentration (using chemical manufacturer recommended test kit).	3 mos
pH.	3 mos
Biological contamination and/or biological inhibitor concentration (using chemical manufacturer recommended test kit).	3 mos
Dose system with appropriate chemicals or drain, flush, and refill system.	as req'd
Cooling Water Recirculating System (Open System)	
Obtain samples and analyze for:	
Total hardness [Ca - less than 900 ppm (as CaCO ₃) and Si - less than 150 ppm].	day

Table 13-1. All water systems (potable and process) (continued)

All Water Systems (Potable and Process)	
<i>Action</i>	<i>Frequency</i>
Alkalinity (maintain between 120 and 125 ppm).	day
Corrosion inhibitor concentration (using chemical manufacturer recommended test kit).	week
pH.	week
Biological contamination and/or biological inhibitor concentration (using chemical manufacturer recommended test kit).	week
Dose system with appropriate chemicals or drain, flush, and refill system.	as req'd
Hot Water Heating Boiler (Closed Loop)	
Obtain samples from the hot water system and analyze for:	
Corrosion inhibitor concentration (using chemical manufacturer recommended test kit).	3 mos
pH.	3 mos
Biological contamination.	3 mos
Boiler – Hot Water and Steam	
Obtain samples of makeup water and analyze for total hardness and silica. Adjust operation of water treatment equipment (water softener, de-alkalizer, or ion exchange unit) to reduce hardness to 0.3 ppm (as CaCO ₃) or less, and to reduce silica to 150 ppm or less.	shift
Steam Boiler	
Obtain samples of returned condensate and analyze for:	
Specific conductance (1,500 micromhos).	shift
pH.	shift
Obtain samples of feedwater and analyze for:	
Oxygen content (less than 5 ppm) or residual oxygen scavenger concentration (using manufacturer recommended test kit).	shift
Total hardness.	shift
pH (maintain between 8.5 and 9.5).	shift
Adjust chemical treatment.	as req'd

¹Or anytime system has been open for maintenance

Table 13-2. Chemical feed system with electric motor-driven reciprocating plunger metering pump

Chemical Feed System with Electric Motor-Driven Reciprocating Plunger Metering Pump	
<i>Action</i>	<i>Frequency</i>
System	
Check level in chemical feed tank and refill as required.	day
Verify that pump is operating and lubricate pump packing.	day
Perform general inspection of system to verify that all components are operating properly and the system is not leaking. Clean strainer element or sludge separator as required.	day
Exercise all system valves and other components not routinely used in the operation	mo
Check calibration of metering pump. Clean check valves as required to maintain accuracy.	yr ¹
Drain chemical feed tank and piping. Thoroughly clean chemical feed tank and flush piping with an appropriate cleaning solution to remove deposits of chemicals.	yr
Metering Pump	
Lubricate pump packing with a lubricant compatible with the liquid being pumped.	day
Inspect packing for leaking and adjust or replace packing as required.	mo
Check gear box oil level and add oil as required.	mo
Change gear box oil. Clean gear box magnetic separator (or strainer, etc.).	6 mos
Lubricate drive motor in accordance with motor manufacturer's recommendations.	yr
Inspect check valves and clean as required. Clean with hot detergent solution and flush with fresh water.	as req'd
Chemical Feed Tank Mixer (Agitator)	
Check level and condition of grease in gear housing and grease as required. (Remove all old grease and pack with new grease any time unit is opened for repair.)	6 mos
Relief Valve	
Inspect valve and verify operation. Adjust, repair, or replace as required.	yr
Back Pressure Valve	
Inspect valve and verify operation. Adjust, repair, or replace as required. (May be required in systems where pump minimum system pressure required for accurate dispensing is greater than actual pressure of system.)	yr

¹No less than yearly; properties of liquid pump may require more frequent checks.

Table 13-3. Chemical feed system with water-powered piston action chemical metering pump

Chemical Feed System with Water-Powered Piston Action Chemical Metering Pump	
<i>Action</i>	<i>Frequency</i>
System	
Check level in chemical feed tank and refill as required.	day
Verify that pump is operating.	day
Perform general inspection of system to verify that all components are operating properly and the system is not leaking. Clean strainer element or sludge separator as required.	day
Exercise all system valves and other components not routinely used in the operation.	mo
Check calibration of metering pump. Clean check valves as required to maintain accuracy.	yr ¹
Drain chemical feed tank and piping. Thoroughly clean chemical feed tank and flush piping with an appropriate cleaning solution to remove all deposits of chemicals.	yr
Water Meter	
See chapter 12 for a discussion of water meters and water meter maintenance.	
Metering Pump	
Inspect check valves and integral suction strainer, and clean as required. Clean with hot detergent solution and flush with fresh water. As required to maintain chemical flow and pump accuracy.	as req'd

¹No less than yearly; properties of liquid pump may require more frequent checks.

Table 13-4. Resin bed softeners and dealkalizers

Resin Bed Softeners and Dealkalizers	
<i>Action</i>	<i>Frequency</i>
Discharge Water Hardness	
Obtain water samples of unit discharge and test for hardness.	day
Based on sample results, adjust brine used for each regeneration cycle, the number of cycles per week and the regeneration time of day to achieve the desired hardness.	as req'd
Record regeneration cycle schedule changes and post at the equipment.	as req'd
Electrolyte Level	
Check electrolyte level. Add additional electrolyte (salt for softener units, stronger caustic or acid for dealkalizer units) as required.	day
Inlet Water Hardness	
Obtain water samples of water supplied to unit and test for hardness.	week
Use results to adjust unit operation for seasonal changes in feedwater quality.	as req'd
Controller Clock	
Verify operation and control settings.	week
Unit Controls	
Verify operation of regeneration controls and devices. Rotate the controller unit through a full cycle (Backwash, Rinse, Flush, and In-Service) and observe operation.	week
Electrolyte Tank Water Level	
Check tank for proper water level.	week

Table 13-5. Resin bed ion exchange unit

Resin Bed Ion Exchange Unit	
<i>Action</i>	<i>Frequency</i>
Water Quality	
Verify that the resistivity of the discharge water is within specifications.	day
Verify the controller is starting and stopping the regeneration cycles as required.	day
Acid Electrolyte	
Verify that there is enough acid electrolyte for the next regeneration cycle.	as req'd ¹
Caustic Electrolyte	
Verify that there is enough caustic electrolyte for the next regeneration cycle. After each regeneration cycle.	as req'd ¹
Water Hardness Testing	
Test the hardness of the discharge of the anion column (caustic electrolyte) during a regeneration cycle. Adjust electrolyte strength as required.	6 mos ²
Water Hardness	
Verify the condition of the anion column resin bed by a test for hardness. If hydroxide hardness is high, a special acid wash cycle may be required. Consult manufacturer's literature.	as req'd ³
Regeneration	
Verify that the regeneration controls and devices are operating properly. Rotate the control unit through a full cycle (Backwash, Rinse, Flush, and In-Service) and observe operation.	week

¹ After each regeneration cycle.² 6 months or if acid electrolyte is exhausted.³ As required to maintain water quality.

Table 13-6. Chemical treatment systems instrumentation and electrical

Chemical Treatment Systems Instrumentation & Electrical	
<i>Action</i>	<i>Frequency</i>
Level Gauges	
Check for accuracy. Recalibrate as required following equipment manufacturer's instructions.	yr
Thermometers	
Check for accuracy. Remove thermometers from their wells and check against calibrated thermometer in controlled temperature bath.	yr
Pressure Gauges	
Isolate pressure gauge by closing the proper valves. Remove and check in a fixture against a calibrated gauge. Adjust as required following equipment manufacturer's instructions.	yr
Control Switch	
Check with a meter or a test light temporarily clipped across the switch. Simulate a trip condition. Switch should operate within 10 percent of desired control action set point.	yr
pH Probes	
Remove probe from line and rinse with fresh water. Calibrate pH unit in accordance with manufacturer's recommendations.	week
Conductivity Probes	
Remove probe from line and rinse with fresh water. Calibrate conductivity unit in accordance with manufacturer's recommendations.	week
Motors	
Check and clean cooling airflow passages on electric motors as necessary so that nothing obstructs airflow.	6 mos
All Electrical Devices	
Check, clean, and tighten terminals at motors, starters, disconnect switches, etc.	6 mos
Wiring	
Check insulation on conductors in starters, switches, and junction boxes at motors for cracks, cuts, or abrasions. Replace wiring as required and correct cause of damage.	6 mos